(12) UK Patent (19) GB (11) 2 195 255 (13) B

(54) Title of Invention

Apparatus for vacuum treatment of an epidermal surface

(51) INT CL[5]; A61H 7/00 9/00

(21) Application No
8623412.7

(22) Date of filing
30.09.1986

(43) Application published
07.04.1988

(45) Patent published
01.05.1991

(52) Domestic classification
(Edition K)
A5R REQ

(56) Documents cited
GB2149655 A
GB1110824 A
GB0379824 A

(58) Field of search

As for published application
2195255 A *viz:*
UK CL A5R
INT CL A61H
updated as appropriate

(72) Inventor(s)
Ole Thorn
Flemming Danhild Feld
Jimmy Palsnow
David Hallam

(73) Proprietor(s)
Ole Thorn
Olsbaek Strandvey 22
2670 Greve Strand
Copenhagen
Denmark

Flemming Danhild Feld
Olsabaek Strandvey 22
2670 Greve Strand
Copenhagen
Denmark

Jimmy Palsnow
Degnestavnen 37
2400 Vopenhagen NV
Denmark

David Hallam
10 Oak Avenue
Cheadle Hulme
Stockport
Cheshire
United Kingdom

(74) Agent and/or
Address for Service
McNeight and Lawrence
Regent House
Heaton Lane
Stockport
Cheshire
SK4 1BS
United Kingdom

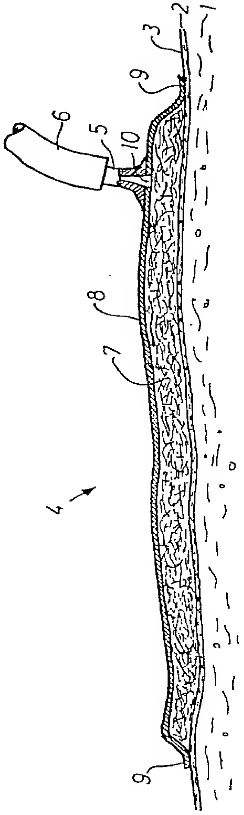

Fig.1

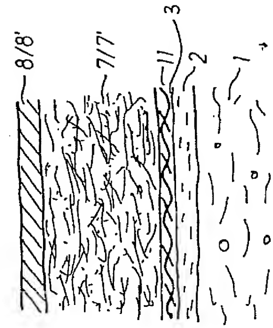

Fig.3

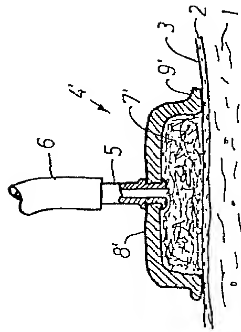

Fig.2

APPARATUS FOR VACUUM TREATMENT OF AN EPIDERMAL SURFACE

The present invention relates to an apparatus for applying subatmospheric pressure or partial vacuum to an epidermal surface.

Previously known apparatus of this kind usually comprise a closed airtight chamber in which the limb or other part of the body whose epidermal surface is to be treated with subatmospheric pressure is placed, which is then evacuated, for example, by using a vacuum pump. To prevent the walls of the chamber from collapsing under the influence of atmospheric pressure, they must have considerable strength, especially in consideration of the subatmospheric pressure possibly being as low as 0.55 bar, corresponding to an external positive pressure on the chamber of almost half an atmosphere. Since the limb or part of the body in question is necessarily connected at one end to the body of the person in question, special measures must be taken to form an air-tight seal between that end of the vacuum chamber, through which the part of the body has been introduced, and that part itself. In cases where the subatmospheric pressure is to be applied to a large part of the body of the person in question, such as the part comprising the thorax and the abdominal cavity, the application of subatmospheric pressure to the outside of this part of

the body may cause internal organs containing air or gases to be distended, and breathing may be disturbed.

Another disadvantage with the known apparatus is that the space within the vacuum chambers around the part of the body or limb may need to be of rather large volume, for which reason it may take a long time to evacuate them.

It is an object of the present invention to provide an apparatus of the kind referred to free of the disadvantages mentioned above and being suitable for implementation by personnel without great technical ability with regard to operating apparatus.

According to the present invention there is provided an apparatus for applying subatmospheric pressure to an epidermal surface, said apparatus comprising an applicator having :

(a) a first layer placed on said surface and consisting of a porous and preferably flexible material of a kind comprising mutually communicating pores not losing the mutual communication when the material is subjected to compressive forces, and

(b) a second layer adapted to be placed over said first layer consisting of airtight and preferably flexible material, said second layer having a greater extent in area than said first layer to form a seal against the epidermal surface and comprising means for applying subatmospheric pressure to said first layer.

Such an apparatus is extremely easy to apply and provides partly the advantage that the force on the epidermal surface caused by the subatmospheric pressure is counterbalanced by the mechanical force produced by the same subatmospheric pressure acting on the second layer and hence on the epidermal surface. This force does, however, act on the epidermal surface solely on the relatively limited contact areas between the pores in the first layer, so that the epidermal surface facing the pores is fully influenced by the subatmospheric pressure. Experience has shown that the effect on the cutis and possibly underlying tissue is not inferior to the effect obtainable by using the previously known methods mentioned above.

The invention will be further apparent from the following description with reference to the accompanying drawing in which :-

Figure 1 is a sectional view showing a region of skin with an applicator according to a first embodiment placed thereon;

Figure 2 is a sectional view similar to Figure 1 through a skin region with an applicator according to a second embodiment;

and Figure 3 shows the use of a protective layer between the skin and the applicator on an enlarged scale.

The drawings shows diagrammatically a skin region consisting if subcutis 1 and epidermis 2, the latter having an external epidermal surface 3.

With the purpose of applying subatmospheric pressure to a part of the epidermal surface 3, there is on that surface placed a vacuum applicator 4, being connected to a source (not shown) of reduced pressure, which may be of a previously known type, through a tube-connecting stub 5 and a flexible tube 6.

In the embodiment shown in Figure 1, the vacuum applicator comprises a first layer 7, lying in contact with a part of the epidermal surface 3. The first layer 7 consists of porous material, the pores of which are interconnected and do not close upon application of a compressive force to the material. Such a material may for example be felt, which - as is well known - consists of mutually entangled fibres of wool or other natural or synthetic fibre. The vacuum applicator 4 further comprises a second layer 8, placed on top of (outside of) the first layer 7 and being so much larger than the latter in the extent of its area, that it is also in direct contact with the epidermal surface 3 with an edge portion 9. The second layer 8 is airtight and may, for example, be constituted by a thin sheet of plastics or rubber. To make it possible to adapt the shape of the vacuum applicator 4 to the shape of the limb or body part in question, both the first layer 7 and the second layer 8 should be flexible, and this condition is fulfilled by using the materials mentioned.

In the second layer 8 there is formed a hole 10, and the tube-connecting stub 5 is secured to the second layer 8 in such a manner, such as by means of glue or cement, that the opening in the stub 5 communicates with the hole 10.

When the source (not shown) of subatmospheric pressure is connected to the flexible tube 6 the space between the epidermal surface 3 and the inside of the second layer 8 is evacuated through the stub 5 and the hole 10. If the first layer 7 were not present in this space, then the space would collapse immediately at the onset of the evacuation, and the second layer 8 would contact the epidermal surface in a fluid-tight manner, so that the subatmospheric pressure in the flexible tube 6 would be unable to reach the region of the epidermal surface covered by the vacuum applicator 4. The porous first layer 7 does, however, in a purely mechanical manner keep the second layer 8 spaced from the epidermal surface 3, for which reason the subatmospheric pressure between the fibres in the first layer 7 can propagate through the entire space between the epidermal surface 3 and the second layer 8, so that the part of the epidermal surface underlying the first layer 7 will in its entirety be subjected to subatmospheric pressure. At the same time, the epidermal surface 3 will be subjected to a mechanical force acting thereupon from the most adjacent fibres in the first layer 7, but since these fibers will only be in contact with a limited portion of the area of the epidermal surface 3, the major part of this surface will be subjected to the subatmospheric pressure.

Apart from the weight of the vacuum applicator 4, no net mechanical force is applied to the limb or body part comprising the epidermal surface 3, because the surface 3 is partly acted upon by an upwardly (as seen in Figure 1) directed force corresponding to the magnitude of the subatmospheric pressure multiplied by the area in question, while the epidermal surface 3 at the same time is acted upon by a downwardly directed force transmitted through the first layer 7, said downwardly directed force being caused by the effect of the very same subatmospheric pressure acting on the inside of the second layer 8, the area of which is substantially the same as the area of the epidermal surface 3 being acted upon. In spite of the apparently paradoxical situation involving the epidermal surface 3 simultaneously being acted upon by two equal and oppositely directed forces, the subatmospheric pressure in the first layer 7 will act upon the tissue below or behind the epidermal surface 3, since the subatmospheric pressure has access to the tissue through a rather large percentage of the surface, only the remaining part of the surface being acted upon by the mechanical force as directed downwards in Figure 1. Thus, practice has shown that by using a vacuum applicator constructed according to the principles illustrated in Figure 1 and explained in the foregoing, it is possible to obtain an effect on the cutis 1 2 and possibly the underlying

tissue at least as effective as that obtainable using previously known apparatus for subjecting epidermal surfaces to subatmospheric pressures.

The first and second layers 7 and 8 respectively shown in Figure 1 may be extended in all directions and shaped in such a manner, that they for example form a bag-like or sleeve-like structure, that may be placed around a greater or smaller part of the body in question. In certain instances, however, it may be desirable to apply subatmospheric pressure to a very limited region of the epidermal surface, and in such cases it is possible to employ a vacuum applicator 4' as shown diagrammatically in Figure 2. Like the vacuum applicator 4 shown in Figure 1, the vacuum applicator 4' shown in Figure 2 also consists of a first layer 7' and a second layer 8'. Of these, the first layer 7' may - apart from the size - be identical to the first layer 7 shown in Figure 1, while the second layer 8' as shown in Figure 2 may be constituted by a vacuum cup, with which the tube-connecting stub 5 and with it the flexible tube 6 are connected in a known manner. The edge portion 9' of the vacuum cup 8' provides the requisite sealing effect against the epidermal surface 3.

In order to avoid the first layer 7 or 7' becoming dirty and to prevent the transmission of

infectious matter from one person to another, it is possible as shown in Figure 3 to place a protective layer 11 between the epidermal surface 3 and the first layer 7 or 7'. The protective layer 11 should - of course - be made of a material capable of both transmitting the subatmospheric pressure and the mechanical force from the first layer 7 or 7', and to this end the protective layer 11 can suitably consist of a textile material, such as sheeting or the like, that may be disposable or laundered and/or sterilized.

The subatmospheric pressure being transmitted to the epidermal surface 3 by means of the vacuum applicator 4 or 4' may be of the order of magnitude 0.05 to 0.55 bar. The source of subatmospheric pressure (not shown) connected to the flexible tube 6 may be provided with means to adjust the subatmospheric pressure, possibly also means to vary this pressure in a pre-programmed manner, so that the subatmospheric pressure may be varied in a manner suitable for providing the desired effect on the epidermal region in question, possibly also the underlying tissue.

It will be appreciated that it is not intended to limit the invention to the above example only, many variations, such as might readily occur to one skilled in the art, being possible, without departing from the scope thereof as defined by the appended claims.

CLAIMS

1. Apparatus for vacuum treatment of an epidermal surface comprising an applicator having :

a first layer placed on said surface and consisting of a porous and flexible material of a kind comprising mutually communicating pores not losing the mutual communication when the material is subjected to compressive forces, and

a second layer adapted to be placed over said first layer and consisting of airtight and flexible material, said second layer having a greater extent in area than said first layer to form a seal against the epidermal surface and comprising means for applying subatmospheric pressure to said first layer.

2. Apparatus according to claim 1, in which the said first layer is a layer of a fibrous material

3. Apparatus according to either of claims 1 or 2, in which the said first layer is felt.

4. Apparatus according to claim 1, in which the said second layer is foil.

5. Apparatus according to claim 1, in which the said second layer is plastic.

6. Apparatus as in either claim 1 or claim 2, in which the second layer is comprised by a vacuum cup having an internal space substantially equal in height to the height of the said first layer and a peripheral edge in contact with an epidermal surface around the said first layer.

7. Apparatus according to either claim 1 or claim 2, further comprising a protective layer of air permeable material adapted to be placed between an epidermal surface and the said first layer.

8. Apparatus according to claim 7, in which the air permeable material is a textile material.